

## Loop versus Divided Colostomy in Patients with High and Intermediate Anorectal Malformations: Randomized Controlled Study

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### ABSTRACT

**Background:** Colostomy is performed as a step of staged management of high-type anorectal malformations in pediatrics. Creating a colostomy, by itself, is a minor surgical procedure, but it has many complications.

**Aim:** The aim of the study was to compare the outcome results of loop versus divided colostomies in patients with high and intermediate anorectal malformations.

**Methods and Material:** This randomized prospective study was performed on 34 patients with imperforate anus. Patients were divided into 2 groups (17 patients each); group A were subjected to loop colostomy and group B were subjected to divided colostomy. **Results:** There was no significant difference between both groups as regards to demographic data (gestational age, sex and birth weight), age of first presentation, associated congenital anomalies and types of fistula. The mean operative time was  $42.05 \pm 6.19$  min in group A and  $51.76 \pm 8.21$  min in group B. The difference between both groups in this point was statistically significant (P value =0.04). The hospital stay and postoperative complications showed insignificant difference between both groups. Patients with loop stomas were significantly more likely to develop prolapse (P=0.033).

**Conclusions:** Both techniques of colostomy are easy to perform and safe in the anorectal malformation (ARM) patients. Loop colostomy had a shorter operative time, but the complications rates, especially prolapse and urinary tract infection (in cloaca patients), are significantly higher in the loop colostomy when compared to the divided colostomy.

**Keywords:** Anorectal malformations - loop colostomy - divided colostomy.

### INTRODUCTION

Anorectal malformations (ARMs) are birth defects in which the anus is absent or malformed. Its incidence is around 1 in 5000 births and affects both genders equally<sup>(1)</sup>. ARM usually requires immediate surgery to open a passage for feces, unless a fistula can be relied upon, or until corrective surgery is done<sup>(2)</sup>.

Colostomy is performed as a step of staged management of high-type anorectal malformations in pediatrics<sup>(3)</sup>. The site and the type of the least troublesome stoma in the surgical management of ARMs were major subjects for argument amongst pediatric surgeons<sup>(4)</sup>.

Creating a colostomy, by itself, is a minor surgical procedure, but has many complications<sup>(5-7)</sup>. Some of these complications are retraction, prolapse, parastomal hernia, intestinal obstruction, skin excoriation, revision, anastomotic leak and wound infections following stoma closure<sup>(8)</sup>.

The aim of the study was to compare the outcome results of loop versus divided colostomies in patients with high and intermediate anorectal malformations.

### SUBJECTS AND METHODS

This prospective randomized study was done at the Pediatric Surgery Unit, General Surgery Department, Tanta University Hospitals after protocol approval by the ethical Approval.

#### Ethical Approval:

The study was approved by the Ethics Board of Tanta University. Full counseling of the candidate's parents for surgery and informed consents

were obtained. There was a code number for every patient's file, this file included photos, videos (the patient's face was not included) and investigations of the patient. Results of our research were only used for academic interest.

This study was carried out on 34 patients with imperforate anus, during the period from September 2017 to September 2018. Patients included in this study were: with high and intermediate ARM, fit for surgery, well-nourished infants and without other major life-threatening anomalies.

Patients were randomly divided into 2 groups; group A: patients who were subjected to loop colostomy and group B: included patients who were subjected to divided colostomy. The randomization was done using the closed envelope method.

All Candidates were subjected to: preoperative workup (to rule out associated anomalies) and this included:

- 1- complete history taking from parents or guardians with focusing on age, consanguinity, course of pregnancy and delivery, similar family history and passage of meconium
- 2- Clinical examination: General physical examination, perineal inspection: for absence of anal opening and condition of perineal musculature and a nasogastric tube was inserted for decompression and to exclude the presence of esophageal atresia.
- 3- Investigations: routine laboratory investigations (CBC, INR... etc.), pelviabdominal US (to exclude other anomalies e.g. single kidney, hydronephrosis, hydrocolpos...etc.), echocardiography (to exclude cardiac anomalies), X-ray spine (to exclude sacral

deformity), spine US (to exclude tethered cord) and invertogram or cross table radiograph.

### **Operative procedure**

Preoperative: All patients were admitted to NICU. The neonate was adequately resuscitated by decompressing the gastrointestinal tract, rehydration, administration of antibiotics and given vitamin K. These patients were kept warm and NPO. Preoperative antibiotics were given parenterally; ceftriaxone 50 mg/kg and metronidazole 7.5 mg/kg. Adequate analgesia was achieved with intravenous acetaminophen 15 mg/kg, given intraoperatively.

All patients received general anesthesia with endotracheal intubation. The patient was placed in the supine position under a radiant heater. The operation site was cleaned and draped in sterile fashion. The line of incision was marked midway between the umbilicus and the anterior superior iliac spine in the left iliac fossa region. A 3 cm transverse incision was made following the premarked line. The incision was deepened through subcutaneous tissue and fascia to expose the muscle layer. The muscle layers were divided to gain access to the peritoneum. The peritoneum was divided to enter the abdominal cavity. The sigmoid colon was identified, mobilized and brought out of the wound.

### **In group A (loop colostomy):**

The colon was exteriorized, and a tunnel was created in the mesentery. The sigmoid colon was held in place by a plastic bridge passed through the mesenteric window created just at the junction with the colon. Sutures were applied between the colon and the sheath. The colostomy was opened, and the edges of the colonic incision were sutured to the adjacent skin margin with 4/0 Vicryl.

### **In group B (divided colostomy):**

The sigmoid colon was divided immediately after displacing the marginal artery. After division of the colon, the effluent was then adequately sucked to prevent peritoneal contamination. The divided ends of the sigmoid colon were held with Babcock tissue forceps or stay sutures to prevent them from falling back to the peritoneum. Sutures were applied between colon and the sheath. These sutures prevented parastomal herniation and bowel evisceration. The proximal end was fixed to the skin of the incision with 4/0 Vicryl. The distal end was thoroughly lavaged with normal saline. This was aimed to prevent fecal impaction and ectasia of the distal colon. Distal stoma was fixed to the skin through another medial small opening leaving a skin bridge in between.

### **Postoperative care**

Regular inspection of the colostomy for reactionary hemorrhage and gangrene was commenced. Adequate fluid was administered to maintain volume and provide calories. Analgesics, antibiotics and vitamin K were administered adequately and appropriately. Colostomy education that was started preoperatively was continued postoperatively. The mother was taught colostomy

care. This was important, because she had to continue the colostomy care at home. Breast milk was commenced as soon as colostomy started functioning, usually within 24-48 hours postoperatively. The patient was then usually discharged home on the fifth to seventh postoperative day. The necessary condition for discharge was satisfactory recovery as well as the mother should have been able to effectively take care of the colostomy.

### **The definite repair:**

A posterior sagittal anorectoplasty (PSARP) was performed 2-3 months later, when the neonate gained appropriate weight, usually more than 5 kg. Performing the definitive repair early in life has important advantages including less time with the abdominal stoma, less size discrepancy between the proximal and distal bowel at the time of colostomy closure, and easier anal dilation (because the infant is smaller). In addition, at least theoretically, placing the rectum in the right location early in life potentially may represent an advantage in terms of acquired local sensation<sup>(9)</sup>.

A colostogram (distal loopogram) was obtained before the definitive repair to identify the presence or absence of a recto-urethral fistula, its level and its shape. Also, to identify the length of the distal segment.

### **Closure of colostomy**

Colostomy was closed when the neo-anus reached the proper size according to the scale of Hegar dilators for age. The mother was taught how to pass the dilators and instructed to dilate the neo-anus twice daily. When the desired size was reached, colostomy could be closed.

### **Measurements:**

Preoperative data: gestational age, sex, birth weight, age of first presentation, consanguinity, associated congenital anomalies and type of fistulae. Operative data: operative time and intraoperative complications. Postoperative data: early postoperative complications and time of discharge and hospital stay.

### **Statistical analysis**

The collected data was analyzed using SPSS (statistical package for social sciences), version 25 (IBM, USA). For quantitative data, the range, mean and standard deviation were calculated and the comparison between the two groups was done by unpaired student t-test. For qualitative data, frequency and percentage were calculated and the comparison between the two groups was done using Chi-square test (X<sup>2</sup>) or Fisher's Exact Test. The level of significance was adopted at P value < 0.05.

## **RESULTS**

The descriptive data of the studied groups are shown in table (1). There was no significant difference between both groups as regards to demographic data (Gestational age, sex and birth weight) and age of first presentation.

**Table (1):** Descriptive data of the studied groups.

	<b>Group A (Loop)</b>	<b>Group B (Divided)</b>	<b>P value</b>
<b>Mean ± SD</b>	37.88 ± 1.32	38.058 ± 1.3	>0.05
<b>Preterm (&lt;37wks)</b>	2 (11.8%)	1 (5.9%)	>0.05
<b>Full term(37-42wks)</b>	15 (88.2%)	16 (94.1%)	
<b>Post term (&gt;42wks)</b>	----	----	
<b>Male</b>	9 (53%)	10 (59%)	>0.05
<b>Female</b>	8 (47%)	7 (41%)	
<b>Mean ± SD</b>	2992.4 ± 466.2	2929.4 ± 360.9	>0.05
<b>Very low birth weight</b>	----	----	>0.05
<b>Low birth weight</b>	3 (18%)	2 (12%)	
<b>Average birth weight</b>	14 (82%)	15 (88%)	
<b>Overweight</b>	----	----	
<b>1st day</b>	13 (76%)	12 (70%)	>0.05
<b>2nd day</b>	4 (23%)	5 (30%)	
<b>Consanguinity (+ve)</b>	2 (11.8%)	1 (5.9%)	>0.05

Associated congenital anomalies are shown in Table (2), types of fistula are shown in Table (3) and there was no significant difference between both groups.

**Table (2):** Associated congenital anomalies in the studied groups

<b>Associated anomalies</b>	<b>Group A (Loop)</b>		<b>Group B (Divided)</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
<b>Skeletal Deformity</b>				
<b>Talipes equine vara</b>	1	5.9%	----	----
<b>Total</b>	1	5.9%	----	----
<b>Urinary system</b>				
<b>PUJ obstruction</b>	1	5.9%	1	5.9%
<b>Hypospadias</b>	----	----	1	5.9%
<b>Single kidney</b>	----	----	1	5.9%
<b>Total</b>	1	5.9%	3	17.6%
<b>Reproductive system</b>				
<b>Hydrocolpos</b>	----	----	1	5.9%
<b>Cloaca</b>	4	23.5%	4	
<b>Total</b>	4	23.5%	5	29.4%
<b>Cardiovascular system</b>				
<b>ASD</b>	2	11.8%	2	11.8%
<b>VSD</b>	2	11.8%	1	5.9%
<b>ASD and VSD</b>	1	5.9%	1	5.9%
	5	29.4%	4	23.5%
<b>Gastrointestinal system</b>				
<b>TOF</b>	1	5.9%	1	5.9%
<b>Duodenal atresia(DA)</b>	1	5.9%	----	----
<b>TOF and DA</b>	----	----	1	5.9%
<b>Total</b>	2	11.8%	2	11.8%
<b>Chromosomal disorder</b>				
<b>Trisomy 21</b>	2	17.6%	3	17.6%
<b>Total</b>	3	17.6%	3	17.6%
<b>P value</b>	>0.05			

\* ASD (Atrial Septal Defect), VSD (Ventricular Septal Defect), TOF (Tracheoesophageal fistula), PUJ obstruction (Pelvi-ureteric junction)

**Table (3):** Type of fistula in the studied groups

	<b>Group A (Loop)</b>	<b>Group B (Divided)</b>
<b>Cloaca</b>	4 (23.5%)	3 (17.6%)
<b>Recto-prostatic Fistula</b>	3 (17.6%)	2 (11.8%)
<b>Recto-Bladder Neck Fistula</b>	4 (23.5%)	5 (29.4%)
<b>Recto-Bulbar Fistula</b>	3 (17.6%)	4 (23.5%)
<b>Without Fistula</b>	3 (17.6%)	3 (17.6%)
<b>P value</b>	>0.05	

The difference between both groups regarding duration of the operation was statistically significant. The difference between both groups regarding hospital stay was statistically insignificant (Table 4).

**Table (4):** The duration of operation and hospital stay

	<b>Group A (Loop)</b>	<b>Group B (Divided)</b>	<b>P value</b>
<b>Duration of operation (min)</b>	42.059±6.19	51.764±8.21	<b>0.001*</b>
<b>Hospital stay (d)</b>	6.647±0.967	6.706±0.824	>0.05

Regarding postoperative complications, patients with loop stomas were significantly more likely to develop prolapse and the number of complications was higher in this group. (Table 5 and Figure 1)

**Table (5):** Postoperative complications

	<b>Group A (Loop)</b>	<b>Group B (Divided)</b>	<b>P value</b>
<b>Retraction</b>	0	0	1
<b>Prolapse</b>	4 (23.5%)	1 (5.9%)	<b>0.0339*</b>
<b>Parastomal Hernia</b>	2 (11.8%)	0	>0.05
<b>Urinary Tract Infection</b>	5 (29.4%)	0	0.0155*
<b>Excoriation</b>	3 (17.6%)	3 (17.6%)	>0.05



(A)



(B)

**Figure (1):** (A) prolapse in loop colostomy (B) parastomal hernia in loop colostomy

## DISCUSSION

Since the first diverting stoma performed for the treatment of imperforate anus in 1783, the site and type of the least troublesome stoma in the surgical management of ARMs have been major subjects for discussion amongst pediatric surgeons<sup>(10)</sup>.

In this study, the operative time in group A ranged between 35 minutes and 55 minutes, with a mean of  $42.05 \pm 6.19$  minutes, and in group B, this ranged between 40 minutes and 65 minutes, with a mean of  $51.76 \pm 8.21$  minutes. On comparing the two groups, the operative time was shorter in group A than group B and the difference was statistically significant (P value 0.04).

**Almosallam et al.**<sup>(11)</sup> reported a mean operative time in their loop colostomies of 54 minutes versus 70 minutes in their divided colostomy patients. The difference was statistically insignificant with P value 0.3.

The shorter operative time in the loop group in our study, though it might reduce the cost (not measured in our study) but was not reflected on the postoperative complications and hospital stay in this study.

In this study, no significant early postoperative complications were reported in either group and no wound infections were noted. The mean hospital stay in group A was  $6.64 \pm 0.96$  days. The mean hospital stay in group B was  $6.7 \pm 0.82$  days. No statistical difference was found between loop and divided colostomy groups in this regard.

In **Akhtar et al.**<sup>(12)</sup> study, that was carried out at the Department of Pediatric Surgery, Sheikh Zayed Medical College, they reported bleeding from the stomas in 11 patients (18.33%) and infection in 7 patients (11.67%). The difference between our study and the other studies is probably due to the small number in the studied groups in our study.

On the other hand, **Almosallam et al.**<sup>(11)</sup> showed no differences between the loop and divided colostomies as regarding the early postoperative course and early complications, as in our study.

**Chowdhary et al.**<sup>(13)</sup> carried out a study on 110 neonates and reported 4 deaths (3.6%). None of the deaths was directly related to the colostomy. Three of them had multiple anomalies and one preterm baby with 1.4 kg died of sepsis. Early complications like hemorrhage and septicemia was met in 4 patients. The difference between this study and our study is that the former study included trainee surgeons while in our study, surgery was performed by experienced surgeons and no trainees.

In our study, we considered the late postoperative complications are those occurring after four weeks post pull-through or complications occurring in the early postoperative period but persist for long time.

Our overall stoma-related complication rate was (53%). Patients with loop stomas were significantly more likely to develop complications (P=0.033) and the number of complications was higher in this group, where prolapse occurred in 4 cases (23.5%), parastomal hernia in 2 cases (11.8%), urinary tract infection in 5 cases (29.4%) and excoriation in 3 cases (17.6%) in the loop colostomy group. While in the divided colostomy group, prolapse was met only in one case (5.9%) and excoriation in 3 cases (17.6%). It needs to be mentioned that the urinary tract infection was only met in cloaca patients.

**Oda et al.**<sup>(4)</sup> reported that stoma-related complications occurred in 34 (23.6%) patients (some with more than one), giving a total of 61 complications in 144 patients. Patients with loop stomas were significantly more likely to develop complications (P=0.031) and the number of complications was higher in this group (P=0.002). On comparing the different rates of each individual complication, only the rate of stoma prolapse was found to be statistically higher in patients with loop stomas (P=0.005). In his loop colostomy group, retraction was found in one case (1.4%), prolapse in 13 cases (17.8%), parastomal hernia in 2 cases (3.0%), urinary tract infection in 12 cases (16.4%) and megarectum in 5 cases (8.2%). Stoma revision was needed in 7 cases (9.6%). Similar rates in their divided colostomy group were (4.2%), (1.4%), (7.0%), (5.3%) and (8.4%) respectively.

**Pena et al.**<sup>(7)</sup> noting urinary tract infections, distal fecal impaction and incidence of (33.9%) of prolapse in loop colostomies, they developed a specific technique with separated stomas in the descending colon that prevented prolapse completely in their studies.

On the other hand, **Almosallam et al.**<sup>(11)</sup>, **Demirogullari et al.**<sup>(14)</sup> and **Liechty et al.**<sup>(15)</sup> reported that there was no difference in rate of complications between loop and divided colostomies, and they suggested that loop colostomy may be more favorable than divided colostomy for ARM patients; as the loop colostomy has a shorter operative time. This does not go hand in hand with our results, Oda's results or Pena results<sup>(4,7)</sup>. We think there is still room for research with regards to this point by much larger, multi-centric studies.

In our study, after PSARP, wound infection was found in 3 cases and retraction of the colon in one case in group A. No complications were met in group B. After closure of colostomy, wound infection was met in only one case in group A which was treated with daily dressing and proper antibiotics according to the result of bacterial culture from the wound. No complications were met in group B.

**Almosallam et al.** <sup>(11)</sup> reported that there was no difference in rate of complications between loop and divided colostomies after PSARP and closure of colostomy.

On balance, our study showed that, loop colostomies took significantly shorter time to perform, but had more complications rates specially prolapse when compared to the divided colostomies. No statistical differences were met in age, sex, associated anomalies, type of fistula, hospital stay and time of discharge. However, our study had several limitations due to the few number of cases included in our study and the short time for follow up.

Further studies to draw hard conclusions to the better colostomy are still needed.

## CONCLUSIONS

Both techniques of colostomy are easy to perform and safe in the ARM patients, reflected by the overall low complication rates in general in our study. Loop colostomy had a shorter operative time, but the complications rates, especially prolapse and urinary tract infection (in cloaca patients), are significantly higher in the loop colostomy when compared to the divided colostomy.

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